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EXPENDABLE LAUNCH VEHICLE PAYLOAD SAFETY REVIEW PROCESS STANDARD

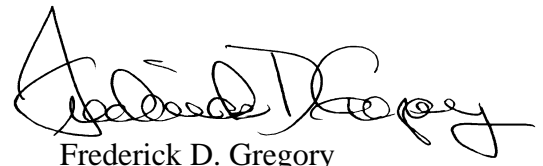
NASA TECHNICAL STANDARD

FOREWORD**Effective Date: June 23, 1998**

This document was prepared by a NASA safety process action team that was formed to develop and document a uniform, common Expendable Launch Vehicle (ELV) payload safety review process for NASA payloads and/or payloads processed at NASA facilities/NASA Contractor facilities. This team, consisting of representatives from NASA Headquarters and Field Installations (GSFC, JPL, KSC, LeRC, MSFC, WFF) and USAF Eastern and Western Ranges, was established to address the following: (1) Among the NASA Field Installations there was no consistent or common safety review process for payloads launched by ELVs; (2) Unlike manned payloads (namely those flown on the Space Shuttle), NASA ELV payloads did not have a safety review process that had been defined or documented by NASA; (3) With the emphasis on smaller, better, faster, and cheaper missions, NASA needed to evaluate and improve current processes to be more efficient and cost-effective without compromising safety.

This document assists NASA payload developers and managers by describing what needs to be done to get a payload through the safety review process and certify that it is safe to process and launch in compliance with applicable safety requirements. The safety review process presented in this document is tailorable and applicable to orbital and suborbital payloads launched by various classes of expendable launch vehicles including sounding rockets and balloons. NASA safety policy is to maintain the assurance of safe design, operation, and processing of a payload and its support equipment. Requirements for assuring payload mission success are the responsibility of the payload organization and are beyond the scope of this document.

Any questions or comments concerning the provisions of this document, or suggested changes for future revisions, should be directed to the Office of Safety and Mission Assurance (Code Q), NASA Headquarters, Washington, DC 20546.



Frederick D. Gregory

Associate Administrator for
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TABLE OF CONTENTS

PARAGRAPH		PAGE
	<u>FOREWORD</u>	i
	<u>TABLE OF CONTENTS</u>	ii
	<u>APPENDICES</u>	iii
	<u>LIST OF FIGURES</u>	iii
	<u>LIST OF TABLES</u>	iii
1.	<u>SCOPE</u>	1-1
1.1	Purpose	1-1
1.2	Applicability	1-1
1.3	Scope	1-1
2.	<u>REFERENCED DOCUMENTS</u>	2-1
2.1	Safety Review Documents	2-1
3.	<u>DEFINITIONS AND ACRONYMS</u>	3-1
3.1	Expendable Launch Vehicle Payload Safety Definitions.....	3-1
3.2	Expendable Launch Vehicle Payload Safety Acronyms.....	3-3
4.	<u>GENERAL</u>	4-1
4.1	Organization, Authority, and Responsibilities	4-1
5.	<u>SAFETY REVIEW PROCESS</u>	5-1
5.1	General.....	5-1
5.2	Initiate Project	5-1
5.3	Perform and Document Safety Assessments	5-10
5.4	Conduct or Participate in Safety and Design Reviews and Working Groups.....	5-10
5.5	Refine/Finalize Safety Assessments	5-11
5.6	Obtain Final Approval.....	5-11

APPENDICES

APPENDIX	PAGE
A. Safety Plan Contents	A-1
B. MSPSP Contents	B-1

LIST OF FIGURES

FIGURE	PAGE
5.1 ELV Payload Safety Review Process Minimum Requirements	5-2
5.2 Typical ELV Payload Safety Review Process Time Line.....	5-7
5.3 ELV Payload Safety Review Process Documentation Flow	5-8

LIST OF TABLES

TABLE	PAGE
4.1 PSWG Chair Assignments	4-2
5.1 Task Descriptions, Responsibilities, and Schedules	5-3

Chapter 1: SCOPE

1.1 Purpose

This document establishes a common, uniform safety review process for NASA ELV payloads to assist payload organization through the process for certifying that the payload is safe to process and launch and is in compliance with applicable safety requirements.

1.2 Applicability

This document is for the use of NASA Headquarters, NASA Field Installations, and associated contractors that are involved with the development of ELV payloads for which NASA has responsibility. It is applicable to NASA payloads including payload provided upper stages flown on ELVs as well as their related Ground Support Equipment (GSE) used to support payload processing and launch operations. This document is applicable to payloads, including interface hardware that is developed as part of a payload managed by NASA, whether developed by NASA or any of its contractors or an independent agency in a joint venture with NASA. Payloads developed under NASA Grants or Co-operative Agreements are not considered NASA Payloads, however before the payload is given access to the NASA facilities or equipment, the grantee shall submit a hazard assessment to the grants officer. Payloads currently under development shall remain obligated to the safety review process requirements to which they are contracted.

1.3 Scope

This document addresses the tasks, responsibilities, safety data package submittals, safety reviews/meetings, and schedules/milestones associated with the ELV payload safety review process. The safety review process for generic launch vehicle systems is outside the scope of this document and is defined by the applicable Approving Authority safety requirements document. The involvement of NASA Headquarters and NASA Field Installations are defined in NHB 1700.1, NASA Safety Policy and Requirements Document. Payload safety design requirements are not covered in this document nor are environmental, biological, health physics, and flight safety approvals. The scope of the safety review process described herein encompasses the following:

- Pre-launch processing and safety of the payload and its integration to the launch vehicle.
- Both large and small payloads, which may be launched by orbital launch vehicles (e.g., Delta, Atlas, Titan, etc.), aircraft, and suborbital launch vehicles such as sounding rockets and balloons. With regard to aircraft, the scope is limited to payloads launched by ELVs that are released by aircraft (e.g., Pegasus).

Chapter 2: REFERENCED DOCUMENTS

Nothing in this document shall be construed as requiring duplication of effort dictated by other contract provisions. Conversely, provisions stated herein shall not be interpreted to preclude compliance with requirements invoked by other provisions. Contractual requirements shall take precedence over this document and the documents listed below. Conflicts shall be referred to the appropriate Contracting Officer.

2.1 SAFETY REVIEW DOCUMENTS

The following is a partial list of documents normally used in the safety review process. The listing of these documents does not indicate that they are applicable to all safety review processes, but is provided for the reader's convenience as applicable. It is implied that the latest version of the documents listed below is the version in effect, unless specifically identified otherwise.

1. "Eastern and Western Range 127-1, Range Safety Requirements."
2. "EWR 127-1 Range User Handbook."
3. NHB 1700.1, "NASA Safety Policy and Requirements Document."
4. KHB 1710.2, "KSC Safety Practices Handbook"
5. NASA/KSC Addendum to EWR 127-1 (Under Development)
6. K-SF-003.7, "Ground Safety Plan Offsite Facility VAFB, CA"
7. GMI 1771.1, "Range Safety Policies and Criteria for GSFC/WFF."
8. RSM-93, "Range Safety Manual for GSFC/WFF" and the "Supplement to RSM-93 for GSFC/WFF--Additional Requirements for Pegasus."
9. "Wallops Flight Facility Range User's Handbook."
10. JPL D-560, "JPL Standard for Systems Safety."

Chapter 3: DEFINITIONS AND ACRONYMS

3.1 EXPENDABLE LAUNCH VEHICLE PAYLOAD SAFETY DEFINITIONS

The following definitions apply within the context of this document.

Accident Risk Assessment Report (ARAR): A report that provides a comprehensive identification and evaluation of the accident risks assumed during the processing and operation of that system throughout its lifecycle. It provides a means of substantiating compliance with the program or project established safety requirements.

Approving Authority: The organization(s) having the responsibility to grant safety concurrence to the NASA Payload Organization to perform processing and/or launch activities in their respective facilities.

Commercial Facility: Refers to a commercially owned facility (e.g. ASTROTECH) where the payload will be processed.

Expendable Launch Vehicle (ELV): These include orbital launch vehicles (such as Delta, Titan, Atlas) and suborbital vehicles (sounding rockets, balloons) that launch payloads.

Ground Support Equipment (GSE): Equipment and associated software furnished to provide ground support, such as monitoring or controlling a specific activity of payload assembly, test, checkout, launch.

Launch Site Safety Office (LSSO): The personnel responsible for the review and approval of the design, inspection and testing of all hazardous and safety critical payloads, ground support equipment, systems, subsystems and material used in the area under their jurisdiction.

Launch Vehicle Supplier: Provider of the primary launch vehicle for launching the payload.

Missile System Prelaunch Safety Package (MSPSP): A data package (along with the ground operations plan) through which launch vehicle/payload prelaunch safety is documented. The MSPSP provides a detailed description of hazardous and safety critical ground support and flight hardware equipment, systems, and materials and their interfaces used for processing/launching ELVs and their payloads.

NASA Launch Vehicle Organization: The NASA lead organization that coordinates NASA payload/launch vehicle safety integration efforts and works with the launch vehicle supplier on all matters related to the safety integration effort.

NASA Payload Organization: The managing or sponsoring organization for the payload, experiment, or mission. For NASA payloads, a NASA Headquarters Enterprise Office is the sponsoring organization and usually delegates to a NASA Center the authority for formal interface with the NASA launch vehicle organization.

NASA Safety: The Director of Safety or their organization/offices responsible for establishing, directing, and implementing a safety program at their respective facility.

Noncompliance: A departure from Safety and Regulation standards or procedures; includes deviations, meets-intent-certifications, variances, and waivers.

Deviation: A designation used when hardware or operational noncompliance is known to exist prior to hardware production or start of operation.

Meets-Intent-Certification (MIC): A noncompliance designation used to indicate that an exact requirement (such as one stated in EWR 127-1) is not satisfied, but an alternate method that maintains an equivalent level of safety is used (MICs are normally identified and documented in the tailoring process).

Variance: Documented and approved permission to perform some act contrary to established requirements (NHB 1700.1).

Waiver: A written authorization to accept an item or condition not compliant to applicable safety requirements (EWR 127-1 and NHB 1700.1).

Payload: Any equipment or material launched on an ELV that is not considered part of the launch vehicle itself. It includes items such as payload provided upper stages, freeflying automated spacecraft, and individual experiments or instruments.

Payload Safety Engineer: Assigned by the NASA Payload Organization to be responsible for safety management of the payload/GSE and coordinates efforts with the Payload Safety Working Group.

Payload Safety Working Group (PSWG): Formed for each NASA payload to ensure compliance with applicable safety requirements and that the safety risk is identified, understood, and adequately controlled.

Pre-launch processing: Activities performed at the launch processing facility(s) prior to lift-off.

Range Safety: The Chiefs of Safety or their organization/offices responsible for establishing, directing, and implementing a safety program at their respective Range.

Safety: Freedom from those conditions that can cause personnel injury, loss of life, or damage or loss of the payload/GSE or the properties such as facilities or equipment.

Safety Assessment Report (SAR): A comprehensive evaluation of the safety risks being assumed prior to test or operation of the system or at contract completion. It identifies all safety features of the hardware and system design and procedural hazards that may be present in the system being acquired and specific procedural controls and precautions that shall be followed.

Safety Review/Technical Interchange Meeting (TIM): The review meeting held by the PSWG in each development phase to assess and confirm whether the payload/GSE and launch site operations comply with the payload safety requirements.

Site Support Office: The office at the processing or launch site that provides support to the NASA Payload Organization.

USAF Facility: Refers to a USAF owned facility (e.g., Vandenberg AFB) where the payload will be processed.

3.2 EXPENDABLE LAUNCH VEHICLE PAYLOAD SAFETY ACRONYMS

ARAR	Accident Risk Assessment Report
CDR	Critical Design Review
ELV	Expendable Launch Vehicle
EWB	Eastern and Western Range
GMI	Goddard Management Instruction
GOP	Ground Operation Plan
GOWG	Ground Operation Working Group
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
H/W	Hardware
JPL	Jet Propulsion Laboratory
KHB	Kennedy Handbook
KSC	Kennedy Space Center
LeRC	Lewis Research Center
LSSO	Launch Site Safety Office
Ltr	Letter
L/V	Launch Vehicle
L-0	Launch
L-12	Launch minus 12 months
L-18	Launch minus 18 months
MIC	Meets Intent Certification
MSFC	Marshall Space Flight Center
MSPSP	Missile System Prelaunch Safety Package
NHB	NASA Handbook

Org.	Organization
PAFB	Patrick Air Force Base
PDR	Preliminary Design Review
P/L	Payload
PSWG	Payload Safety Working Group
SAR	Safety Assessment Report
TIM	Technical Interchange Meeting
USAF	United States Air Force
VAFB	Vandenberg Air Force Base
WFF	Wallops Flight Facility
WG	Working Group

Chapter 4: GENERAL

4.1 ORGANIZATION, AUTHORITY, AND RESPONSIBILITIES

4.1.1 NASA Payload Organization The payload organization is the managing or sponsoring organization for the experiment, payload, or mission. This may include the principal investigator, payload contractor, designer, or developer, to an extent authorized by the sponsoring organization. For NASA payloads, a NASA Headquarters Enterprise Office is the sponsoring organization and usually delegates to a NASA Center the authority for formal interface with the launch vehicle organization. The NASA Center shall assign a Payload Safety Engineer that is responsible for the safety management of the payload/GSE and coordinates efforts with the Payload Safety Working Group discussed later. The tasks assigned to the NASA Payload Organization are shown in Table 5.1.

4.1.2 NASA Launch Vehicle Organization The NASA launch vehicle organization is the NASA lead organization for the coordination of all NASA payload/launch vehicle safety integration efforts and shall work with the launch vehicle supplier on all matters related to the safety integration effort. The launch vehicle supplier provides the primary vehicle for launching the payload. The NASA launch vehicle organization shall interface with the payload organization to review the payload for adequate safety implementation and compliance for integrated activities. The NASA Launch Vehicle Organization establishes a co-operative relationship with the PSWG to assist in the inter-linking of safety activities between the NASA Payload Organization, the Launch Vehicle Supplier, and the Approving Authority. The Program Office at the NASA launch vehicle organization shall ensure that appropriate NASA support is provided for the payload safety review process.

4.1.3 Payload Safety Working Group The PSWG is established by the Approving Authorities and the NASA Payload Organization. A PSWG shall be formed for each NASA payload to ensure inter-organizational compliance with applicable safety requirements and that the safety risk is identified, understood, and adequately controlled. Activities will be conducted in PSWG safety splinter sessions, which will be held in conjunction with other scheduled meetings such as Preliminary Design Reviews (PDR), Critical Design Reviews (CDR), Ground Operations Working Group (GOWG) meetings or Technical Interchange Meetings (TIM). The primary function of the PSWG is to provide the Payload Project Manager recommendations for acceptance or rejection of the analyses which support the Payload Organization's certification that safety risk is adequately controlled. The PSWG recommendations are based on assessments of the design, integration, pre-launch and launch operations of the payload and its integration to launch vehicle systems, which includes the launch complex. This PSWG function is accomplished by reviewing safety analyses, reports, safety critical test plans, and any other relevant documentation submitted by the payload organization to the launch site safety organizations. The PSWG utilizes the safety expertise from the various groups that normally perform the safety activities, it is not an independent assessment function. The PSWG will provide a defined and structured approach to resolving safety related issues early in the payload design and integration

process. The assignment of a Chairperson(s) for the PSWG is based on where the payload is processed, as shown in Table 4.1.

Table 4.1
PSWG CHAIR ASSIGNMENTS

Facility “Owner”	NASA Facility Safety	USAF Range Safety	Commercial Facility Safety
NASA	X		
USAF		X	
Commercial			X
Commercial on Government Property		X	X

Note: The Site Support Office shall support USAF Safety when USAF chairs the PSWG.

Duties of the Chairperson(s) shall include, but not be limited to leading safety meetings and coordinating agendas, minutes, and action items, maintaining a meeting schedule, and ensuring that members and invitees are notified of PSWG activities. As appropriate the PSWG shall include but not be limited to, safety representatives from the NASA launch vehicle organization and contractor, NASA payload organization and contractor, NASA upper stage organization and contractor, NASA facility, Commercial Processing facility, and Range Safety. Each PSWG member is responsible for coordinating the safety review efforts within his organization and will have voting rights on any safety issues, which might arise. The Site Support Office may participate as a non-voting member of the PSWG. In the absence of consensus, the chairperson shall ensure that the issue is elevated to upper level Safety Management for resolution.

The PSWG shall interact closely with the NASA payload organization to resolve action items and safety concerns related to the project. The PSWG also shall work in coordination with other safety-related working groups such as those associated with launch vehicle integration and ground operations. Furthermore, PSWG members and their technical support should participate in the major payload design or safety meetings.

Chapter 5: SAFETY REVIEW PROCESS

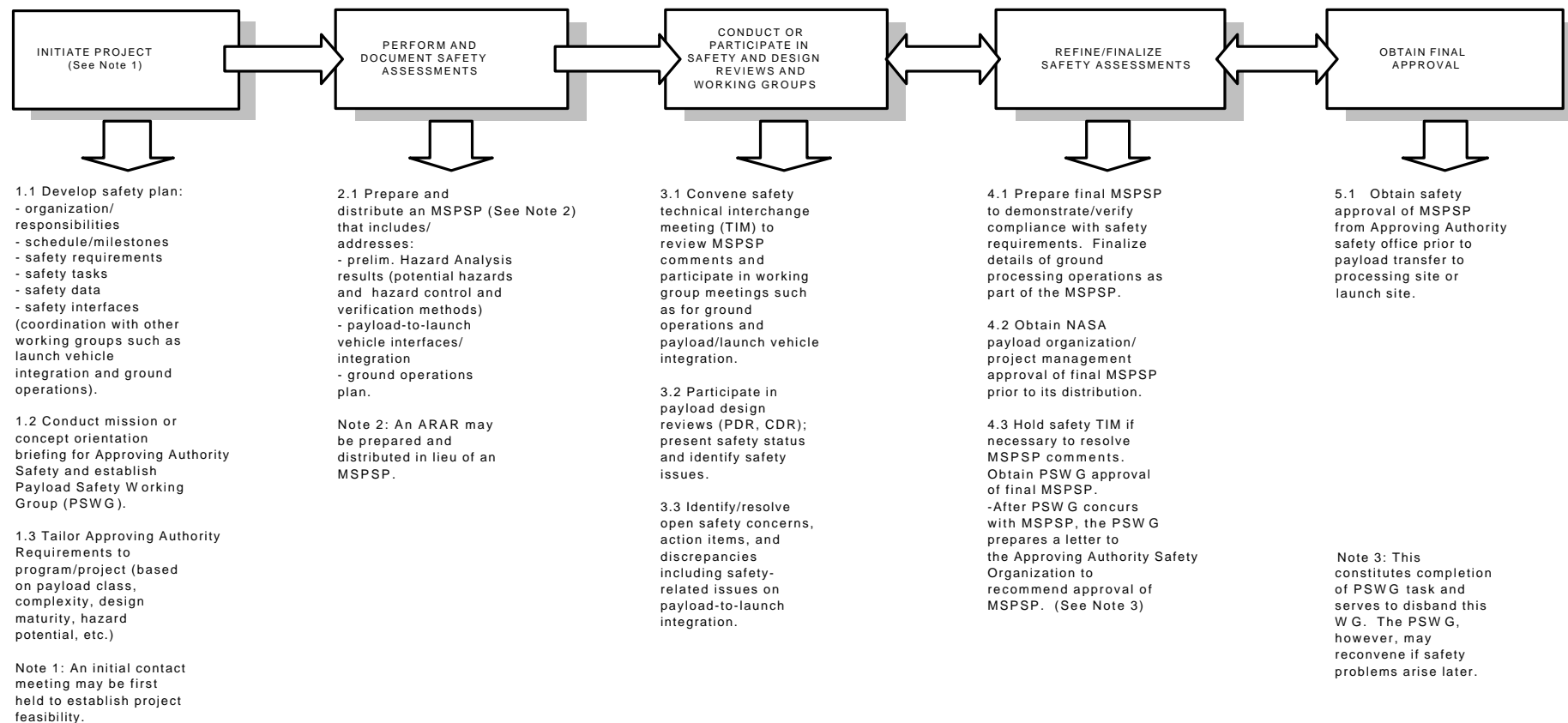
5.1 General

Figure 5.1 depicts the primary tasks of the ELV payload safety review process. Table 5.1 provides additional information (description, expected output, data submittal/approval and schedule) about the tasks addressed in Figure 5.1. The subparagraph numbers 1.1 through 5.1 used in this chapter correspond to the subtasks listed in Figure 5.1 and Table 5.1. In general, the major tasks (initiate project, perform and document safety assessments, conduct or participate in safety reviews, refine safety assessments, and obtain approval) are part of the safety review process regardless of whether the process is for a large or small payload launched by orbital vehicles, aircraft, or suborbital vehicles such as sounding rockets and balloons. The safety review process differences among payload projects and types may involve the specifics of the subtasks such as the number of safety assessments and submittals required and the number of safety reviews or meetings that are held to certify that a payload is safe for launch. The following sections will address some of the tailorable aspects (e.g., combined reviews, meetings held in conjunction with others) of the payload safety review process.

Safety reviews shall normally be conducted in conjunction with program milestone reviews. For payloads already developed, ground qualified and launched from another launch base, the formal submission procedure may be shortened. Time lines may be compressed for small projects such as payloads launched by balloons/sounding rockets, or expanded for larger or more complex payloads launched by orbital launch vehicles. Figure 5.2 depicts a typical ELV payload safety review process time line. Figure 5.3 depicts the major ELV payload safety review process documentation that is prepared and submitted for review and approval. Exact safety data requirements shall be determined during the planning process based on schedule and project unique details. Any new or mission unique components or subsystems shall require review and approval. Series payloads or payload elements that are of the same or similar design as a previously flown payload may obtain safety certification by referring to the previously certified element and explaining that the present application is identical or how it differs. Because safety methods and requirements change over time, prior safety approvals and prior flight experience do not guarantee the granting of safety approvals for subsequent missions. The depth, number, and scheduling of safety reviews, which may be dependent on payload complexity, technical maturity, and hazard potential, shall be negotiated with involved parties (e.g., payload organization and Approving Authority).

5.2 Initiate Project

Initial Contact Meeting to Establish Feasibility. After the project team is assembled, the payload organization Launch Site Manager or an appropriate project representative should request the Approving Authority to establish an informal meeting between the payload organization and Approving Authority technical personnel to exchange preliminary information and to reach a tentative position on the feasibility of conducting the mission/project. After agreement on feasibility of a project, the Site Support Office shall prepare and transmit to the Approving Authority a program introduction letter, providing the best available information regarding the anticipated program (brief overview of the support required, the safety aspects,



**FIGURE 5.1 - ELV PAYLOAD SAFETY REVIEW PROCESS
MINIMUM REQUIREMENTS**

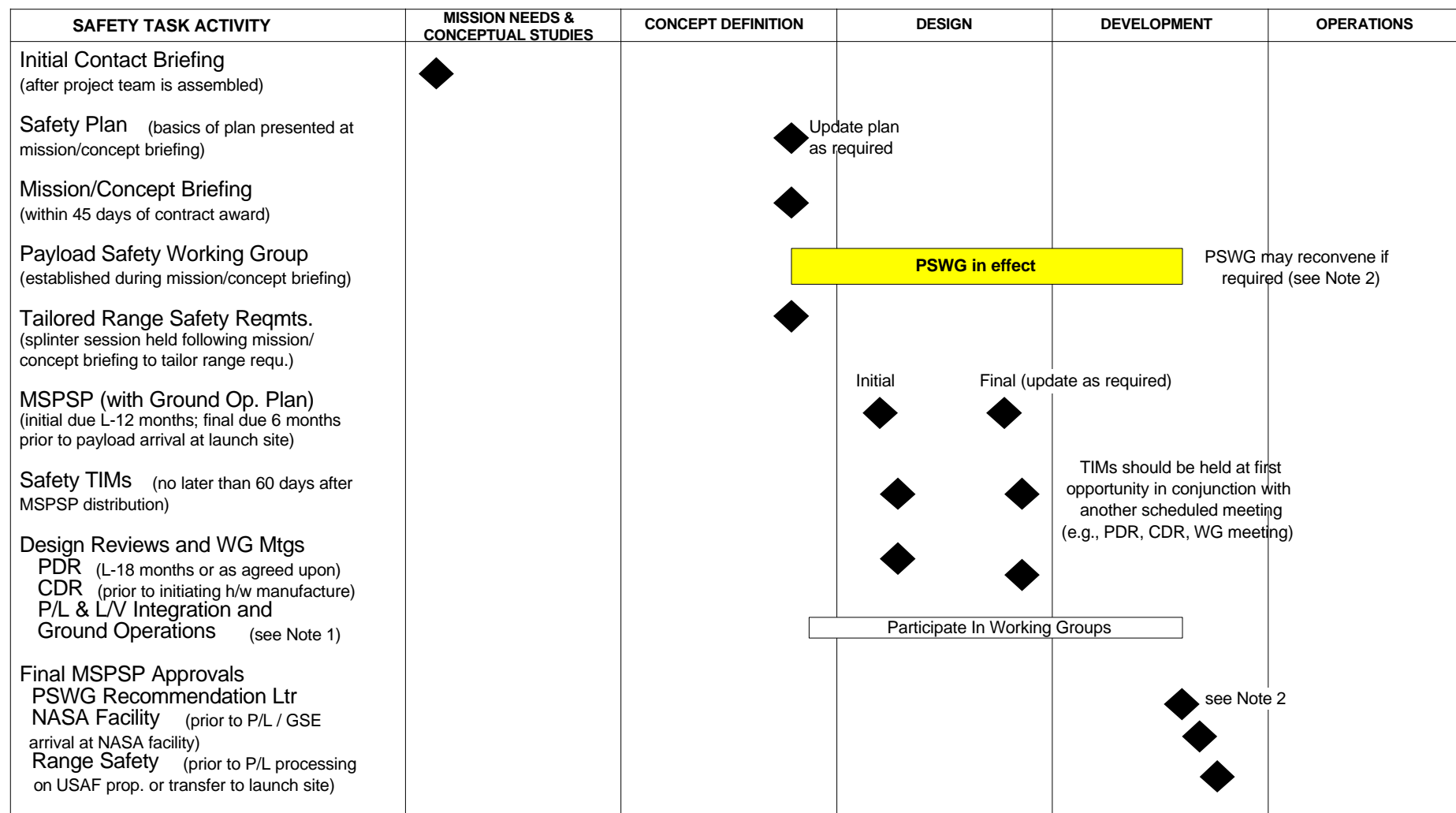
TABLE 5.1
TASK DESCRIPTIONS, RESPONSIBILITIES, AND SCHEDULES

Task #	Safety Task Description	Responsibility (Who prepares/approves document or participates in meeting)	Product or Meeting (Output)	Schedule (When document is submitted, meeting held, or approval/response is due.)
1.1	Develop safety plan.	NASA payload organization.	Plan addressing what will be done by the payload organization to meet safety requirements for the Approving Authority.	Basics of plan to be presented at mission or concept orientation briefing.
1.2	Conduct mission or concept orientation briefing for the Approving Authority safety.	NASA payload organization sets up meeting and gives presentation to Approving Authority safety. Invitees include representatives as appropriate from NASA L/V organization and contractor, payload contractor, NASA upper stage organization and contractor, commercial processing facility, and site support office.	Meeting held to begin safety review process, acquaint involved agencies with program, mission, and payload and establish membership and organizational structure of Payload Safety Working Group.	Typically within 45 days of Project start (contract award). Mission or concept approval/response provided by Approving Authority at briefing or within 14 days after briefing.

Task #	Safety Task Description	Responsibility	Product or Meeting	Schedule
1.3	Tailor Safety Requirements.	Payload Safety Working Group with representatives as appropriate from NASA L/V organization and contractor, NASA P/L organization and contractor, Range Safety, NASA facility safety, NASA upper stage organization, commercial processing facility, and contractor site support office.	Splinter session held to generate a document containing Approving Authority safety requirements that are appropriate to the project/payload. As project matures, document may require revision to reflect latest designs.	Splinter session held by Payload Safety Working Group following mission or concept orientation briefing.
2.1	Prepare and submit an MSPSP.	NASA payload organization.	MSPSP (includes prelim. Hazard analysis results, payload-to-launch vehicle interfaces/integration, and ground operations plan).	Typical delivery of the MSPSP is approx. 12 months prior to launch. Note: Approving Authority responses generally are provided within 45 days after receipt of data package.
3.1	Convene safety technical interchange meeting (TIM) and participate in working group (WG) meetings.	Payload Safety Working Group conducts safety TIM(s). Payload Safety Working Group members participate in WG meetings such ground operations and payload/launch vehicle integration.	Safety TIM held to review MSPSP comments. NASA payload organization provides safety program status and schedule, TIM findings, and addresses any relevant safety-related topics at WG meetings. Concerns/issues and action items documented in TIM and WG meeting minutes.	Typically, no later than 60 days after MSPSP distribution. Should be held at first opportunity in conjunction with another scheduled meeting.

Task #	Safety Task Description	Responsibility	Product or Meeting	Schedule
3.2	Participate in payload design reviews.	NASA payload organization will ensure that Payload Safety Working Group members are invited to the reviews and furnished pertinent information from the reviews.	NASA payload organization presents safety status and identifies safety issues at the reviews. Safety-related concerns/issues and action items documented in meeting minutes.	Payload PDR: Typically L-18 months or as agreed upon. Payload CDR: Prior to initiating h/w manufacture or as agreed upon.
3.3	Resolve open safety concerns, action items, and discrepancies including safety-related issues on payload-to-launch integration identified by reviews and working groups.	NASA payload organization and Payload Safety Working Group.	Response and resolution/closure of concerns and action items.	As assigned and documented in meeting minutes.
4.1	Prepare a final MSPSP to demonstrate/verify compliance with safety requirements. Finalize details of ground processing operations as part of the MSPSP.	NASA payload organization.	The final MSPSP (update of previous submittal, incorporating comments received during earlier document reviews as appropriate).	Typically 6 months prior to payload arrival at processing or launch site.
4.2	Obtain NASA payload organization/project management approval of the final MSPSP prior to its distribution.	NASA payload organization.	Memo from NASA payload organization management documenting comments or approval.	Approval required prior to distribution of final MSPSP to Payload Safety Working Group.

Task #	Safety Task Description	Responsibility	Product or Meeting	Schedule
4.3	Hold safety TIM if necessary to resolve MSPSP comments. Obtain Payload Safety Working Group approval of the final MSPSP.	Payload Safety Working Group and NASA payload organization.	Resolution of MSPSP comments and approval from the Payload Safety Working Group and NASA payload organization of changes, if any, to the final MSPSP. After Payload Safety Working Group (PSWG) concurs with MSPSP, letter recommending MSPSP approval is prepared by PSWG and forwarded to Approving Authority Safety organizations.	Should be at first opportunity and, if possible, in conjunction with other meetings (e.g., PDR and CDR).
5.1	(5) Obtain safety approval of the final MSPSP from NASA Facility safety office. (b) Obtain Range Safety approval of the final MSPSP.	(5) Facility safety office. (b) Range Chief of Safety or designated representative.	(a) & (b) Approval in the form of a letter or memo.	(5) Prior to payload/GSE transfer to processing site. (b) Before payload transfer to the launch site if payload is not processed on USAF property.

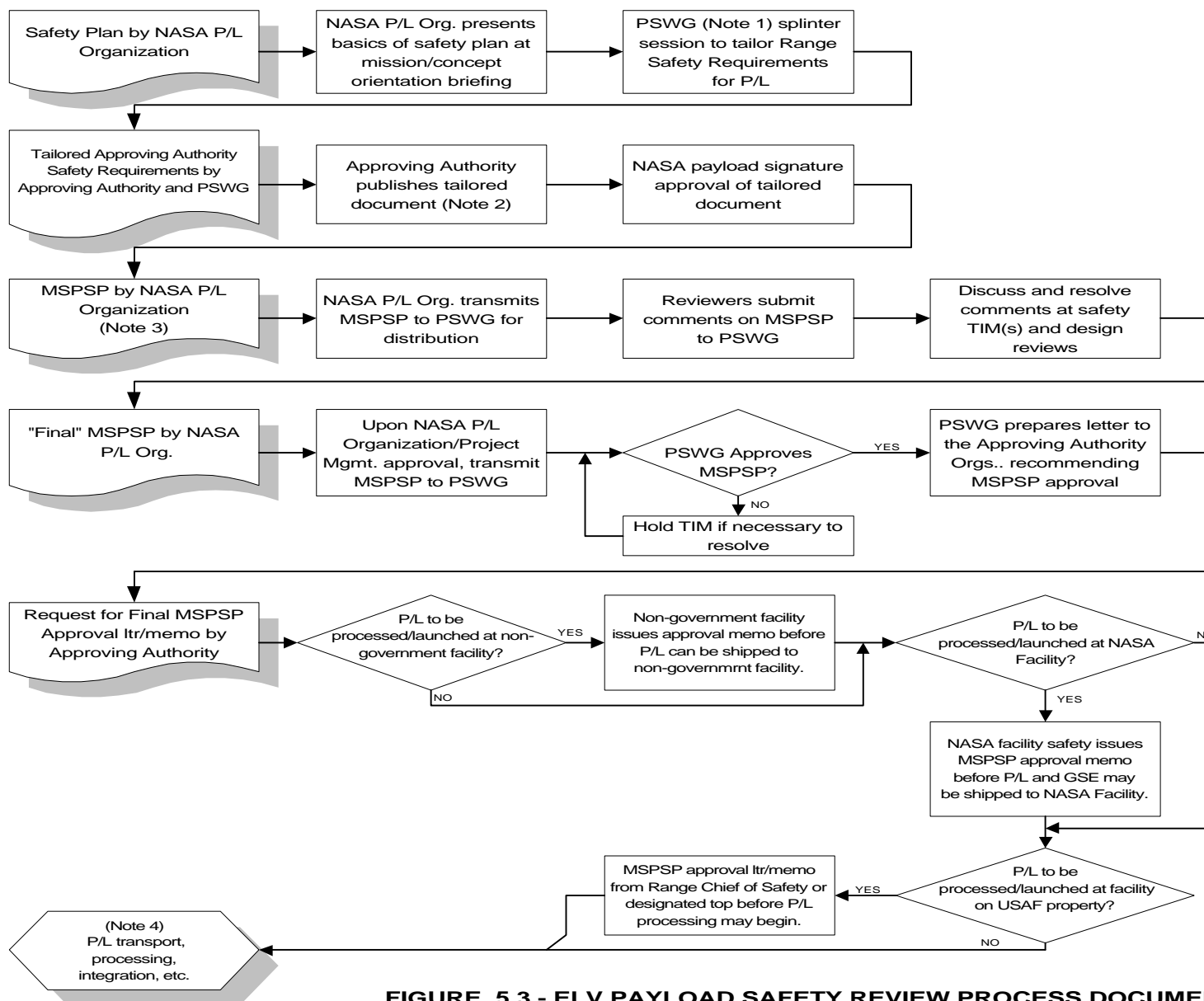


Notes:

1. PSWG shall work in coordination with other safety-related working groups such as those involving L/V integration and ground operations.
2. After PSWG concurs with final MSPSP, the PSWG issues a letter to the Approving Authority's (ies') organizations to recommend MSPSP approval; this constitutes completion of PSWG task. PSWG, however, may reconvene if safety problems arise later.

L-0 (launch)

FIGURE 5.2 - TYPICAL ELV PAYLOAD SAFETY REVIEW PROCESS TIME LINE



Notes:

1. PSWG includes a representative as appropriate from NASA L/V Organization and Contractor, NASA P/L Organization and Contractor, NASA upper stage organization and Contractor, Site support office (as appropriate) NASA Facility Safety, Non-government Processing Facility Safety, and USAF Range Safety.

2. As program matures, tailored document may require revision to reflect latest designs and processing operations. Noncompliance requests are to be submitted to applicable Safety Office(s) for approval when a safety requirement cannot be met.

3. The term "MSPSP" includes the MSPSP, GOP and supporting documents. Procedures are part of the safety documentation; however, they will be transmitted directly from the NASA P/L Organization to the Site Support Office for distribution to the required organization.

4. This completes the major safety approval for the payload. Additional documentation and approvals are required prior to final launch approval. Consult appropriate Range requirements.

FIGURE 5.3 - ELV PAYLOAD SAFETY REVIEW PROCESS DOCUMENTATION FLOW

and the operational requirements of the project). Early contact with the Approving Authority is essential to allow the Approving Authority to start the planning and activities required to support the program. Advance planning and early interface with Approving Authority personnel are essential to avoid safety related engineering changes and schedule impacts.

Task number 1.1 Prepare Payload Safety Plan. A safety plan shall be prepared by the NASA payload organization to provide a basis of understanding on how the safety program will be executed to meet safety requirements such as those imposed by the Approving Authority. The plan shall contain appropriate depth and detail to define the tasks required to identify, evaluate, and eliminate hazards, or reduce the associated risk to an acceptable level. The plan shall describe how the payload organization will interface and coordinate safety-related activities with other working groups such as launch vehicle integration and ground operations. Additional details and the contents of a payload safety plan are provided in Appendix A. The basics of the safety plan (safety program scope, the functional and administrative organizational structure, responsibilities, schedule milestones, and descriptions of applicable system safety tasks, requirements, and integration with other project engineering and management activities) shall be presented at the mission or concept orientation briefing. Approving Authority approval is not required for this plan.

Task number 1.2 Conduct Mission or Concept Orientation Briefing for the Approving Authority. The NASA payload organization shall give a mission (for existing payloads) or concept (for new payloads) orientation briefing to the Approving Authority within 45 days after Project start. The briefing purpose is to (1) acquaint involved agencies, Range, NASA facility, launch vehicle organization, etc., with the program, the mission, and the spacecraft itself; (2) establish membership and organizational structure of the Payload Safety Working Group (PSWG); and (3) establish Working Group membership roles and responsibilities.

Task number 1.3 Tailor Approving Authority Safety Requirements. Following the mission or concept orientation briefing, the PSWG shall meet in a splinter session to review the program safety requirements document for applicability to the payload/project. The applicable Approving Authority Safety document, such as EWR 127-1 for Eastern and Western Range launches, shall be tailored to contain only those requirements that apply to the program. The tailored document is published by the Approving Authority. Approval of the tailored document by the NASA payload Project Manager (or his designee) is required. NASA payload signature approval of the tailored document will be determined by the PSWG at the tailoring meeting. The tailored document will become the program safety requirements document against which safety compliance will be measured. As the program matures, this tailored document may require revision to properly reflect the latest designs and processing operations. This would be addressed by the PSWG in subsequent meetings (TIMs).

If a specific safety requirement cannot be met, documentation shall be prepared to identify the hazard and provide rationale for acceptance of a noncompliance. A noncompliance request shall be generated and submitted to the cognizant Safety Office(s) for approval as soon as it is determined that a safety requirement cannot be met.

5.3 Perform and Document Safety Assessments

Task number 2.1 Prepare and Distribute a Safety Data Package. Hazard analyses shall be conducted on the systems, subsystems, and components of the payload/GSE and the launch site operations, including analyses of the interfaces, to identify existing and potential hazards. The payload interfaces including those between the launch vehicle and the payload, between the subsystems and components constituting the payload system, and between the payload and the relevant GSE and launch site equipment facilities shall be assessed. Data such as hazard identification, classification, and disposition, as well as a record of safety-related failures shall be included. Payload and mission unique design and operations of the integrated launch vehicle system shall be reviewed.

Safety data and analyses such as hazard analysis results shall be documented in a Safety Data Package or Missile System Prelaunch Safety Package (MSPSP) to support payload related project and technical reviews. An Accident Risk Assessment Report (ARAR) or a Safety Assessment Report (SAR) may be prepared and distributed in lieu of an MSPSP. Appendix B is a list of MSPSP contents.

A Ground Operations Plan (GOP) or equivalent, which provides a detailed description of hazardous and safety critical operations for processing the payload and its associated GSE may be issued as a separate, stand alone document or may be included in the MSPSP. If the GOP is a stand alone document, it shall be developed and submitted to Approving Authority Safety concurrently with the MSPSP for review and approval. Brief summaries of all operating procedures (with designation as hazardous, non-hazardous or safety critical) shall be submitted as part of the GOP. Prior to the start of any hazardous or safety critical operation, the GOP and the applicable procedure shall have been approved.

5.4 Conduct or Participate in Safety and Design Reviews and Working Groups

Task number 3.1 Convene Safety Technical Interchange Meeting (TIM). A safety TIM shall be held to review and discuss comments against the MSPSP. In general, as part of the emphasis toward smaller, cheaper, faster, and better projects, the safety reviews or TIMs shall be held at first opportunity in conjunction with other working group meetings, design reviews, or launch vehicle integration meetings as discussed below. PSWG members should participate in Ground Operations Working Group (GOWG) meetings that follow the PSWG TIM. At the GOWG, the NASA payload organization shall make a presentation that provides safety program status, results of the previous TIM, and schedule status and address any other safety-related topics that might be appropriate.

Task number 3.2 Participate in Payload Design Reviews. Each NASA program typically holds at least a preliminary design review (PDR) and critical design review (CDR) during the course of a program. The NASA payload organization is responsible for ensuring that PSWG members are invited to these reviews and furnished pertinent information from these design reviews. Approving Authority operations and safety personnel shall be invited to participate in project design reviews and technical interchange meetings in order to assure that concerns are addressed early in the planning phase. Safety evaluation must be an integral part of the design reviews held,

and compliance/noncompliance of the design with the project safety criteria, identified existing and potential hazards, and hazard resolution methods shall be reviewed. At each review, the NASA payload organization Safety Manager shall make a presentation on safety status, hazard analysis results, schedule, and any other safety issues that should be addressed. The PSWG members can submit requests for action through the review board to get a response on areas of concern.

Task number 3.3 Identify/Resolve Open Safety Concerns, Action Items. This is an iterative task that involves the resolution of action items, discrepancies, and noncompliances. Safety noncompliances, waivers, and deviations shall be completed and approved by the responsible individuals. The payload organization shall maintain a verification tracking log that tracks items requiring verification during ground processing and before launch.

5.5 Refine/Finalize Safety Assessments

Task number 4.1 Prepare Final MSPSP. The completed MSPSP shall incorporate all changes and redesigns, final hazard analyses identifying hazards, methods of control and final verifications, and final details of ground processing and launch operations.

Task number 4.2 Obtain NASA Payload Organization Management Approval of Final MSPSP. Management approval and submittal of the MSPSP shall constitute certification of the MSPSP's completeness, accuracy and validity. The MSPSP shall be distributed to the PSWG.

Task number 4.3 MSPSP Resolution TIM. If necessary due to substantive comments, a safety TIM shall be held to resolve MSPSP comments, open items, and discrepancies. After the PSWG has reviewed and concurred with the MSPSP, the PSWG shall prepare a letter to the Approving Authority's (ies') Safety organization(s) to recommend approval of the MSPSP. This would complete the PSWG's task and serve to disband it with the understanding that the Working Group could reconvene if safety problems arise later.

5.6 Obtain Final Approval

Task number 5.1 Obtain Safety Approval of MSPSP. Safety approval of the MSPSP is required from the appropriate Approving Authority prior to transfer of the payload to the processing or launch site.

APPENDIX A: SAFETY PLAN CONTENTS

The contents of the safety plan shall include the following:

- Safety Policy: State policy and project goals concerning safety.
- Safety Program Organization, Authority, Responsibility, and Interfaces: Describe system safety organization function within the organization of the total program using charts to show organizational and functional relationships (interfaces) and lines of communication. Identify the organizational elements, groups, or committees responsible for safety program functions and deliverables. Describe the authority of these elements to resolve identified hazards and unsafe conditions. Identify the specific safety roles and responsibilities to be assigned. Identify interfaces between system safety and (1) other applicable safety disciplines such as nuclear, range, explosive and ordnance safety; (2) systems engineering and other support disciplines such as quality control, reliability, software development, and human factors engineering; and (3) system integration and test disciplines.
- Safety Program Management and Implementation: Identify the procedures, techniques, methods, and documentation that will be used to manage safety requirements. Include the following when applicable.
 - a. Assignment of responsibility and designation of methods for identification and control of hazards (e.g., hazard analyses, risk assessments).
 - b. Identification of methods to ensure development of written procedures for hazardous operations required (including testing) for safe task performance.
 - c. Identification of methods to ensure that documentation setting forth inspection procedures, test procedures, and other related information identifies the relevant hazardous situations and includes proper cautions and notifications.
 - d. Details for training and certification of personnel who will perform functions that have been determined to be hazardous.
 - e. Assignments, procedures, and frequency for regular inspection and evaluation of work areas for hazards and accountability for implementation of corrective actions.
 - f. Responsibilities and methods for internal audit and evaluation of overall safety program.
 - g. Procedures for mishap reporting and accident investigation, implementation of corrective actions, and development of lessons learned.
 - h. Details of control over the program for handling hazardous materials that involve safety aspects (e.g., storage, labeling, issue, use, and disposal).
 - i. Responsibilities and procedures for procurement, inspection, and maintenance of safety protective clothing and equipment.
 - j. Description of the safety noncompliance process.

- Safety Program Milestones: Provide a schedule with milestones for major program phases/activities and the related safety program deliverables. Provide program schedule of safety tasks, including start and completion dates, reports, and reviews.

APPENDIX B: MSPSP CONTENTS

As a minimum, an MSPSP shall contain the items listed below. As mentioned previously, an Accident Risk Assessment Report (ARAR) or a Safety Assessment Report (SAR) may be submitted in lieu of an MSPSP if the proper data are provided and presented in a format similar to that of an MSPSP and agreed to by the appropriate Approving Authority.

- Introduction: Identify the purpose of the mission, the type of launch vehicle, mission time line, and trajectory.
- General Description: Provide an overview and description of the payload, including the size, weight, type and quantity of propellants and overall configuration for launch and flight. Provide a summary of the overall payload hazards identified to date as well as a listing of hazardous materials.
- Subsystem Descriptions: Describe each hazardous subsystem as to function, location, and operation. Use sketches, flow charts, logic diagrams and/or functional block diagrams to explain how the system operates. Address hazards associated with the subsystem and any provisions to control or mitigate the hazards.
- Ground Support Equipment (GSE): Provide a detailed description of the GSE (organized by hazardous subsystem) and how and where it is to be used. Include a section on personnel protective equipment.
- Ground Operations: Describe all ground operations, including where they are to be performed and precautions to be taken to insure safety. Identify each operation as hazardous or nonhazardous. List and describe procedures in summary form. Provide a flow chart showing sequence, location and timing of operations. Address emergency and abort back-out provisions. (The ground operations plan may be issued as a separate, stand-alone document or included as part of the MSPSP.)
- Compliance Checklist: Provide a checklist of applicable design, test, analysis, and data submittal requirements. Indicate for each requirement if the proposed design/processing operation is compliant, noncompliant but meets intent, noncompliant or non-applicable. Provide copies of waivers, meets intent certifications, etc. Required analyses, test plans, and test results may be included as appendices to the MSPSP or submitted separately (these should be listed, referenced, and summarized in the MSPSP as a minimum).
- Modification to MSPSP: Provide a summary of the changes to the last edition of the MSPSP. Flag modified sections of the document with change bars.